UNITED STATES MARINE CORPS
Logistics Operations School
Marine Corps Combat Service Support Schools
Training Command
PSC Box 20041
Camp Lejeune, North Carolina 28542-0041

AOM 6311

STUDENT HANDOUT

INTRODUCTION TO AUTOMOTIVE WIRING AND LIGHTING DIAGRAMS

LEARNING OBJECTIVE

1. TERMINAL LEARNING OBJECTIVE: Given a student handout entitled "Automotive Electrical System Wiring Diagrams," and a wiring diagram for a tactical motor vehicle electrical system, trace five circuits on the wiring diagram, per information contained in the reference provided. (6.3.10)

2. ENABLING LEARNING OBJECTIVES: Given a student handout entitled "Automotive Electrical System Wiring Diagrams," and a wiring diagram for a tactical motor vehicle electrical system, per information contained in the reference provided, trace the:

a. horn circuit from the horn assembly to the light switch, (6.3.10a)

b. left headlight circuit from the left headlight to the high beam switch, (6.3.10b)

c. right front blackout circuit from the right front blackout lamp to the light switch, (6.3.10c)

d. fuel quantity indicating circuit from the fuel quantity gage to the fuel level sending unit, and (6.3.10d)

e. backup lamp circuit from the right backup lamp to the backup lamp switch. (6.3.10e)

OUTLINE

1. WIRING AND LIGHTING SYSTEMS

a. Wiring and Lighting Components and Symbols

(1) Power is supplied to the wiring and lighting system components by standard military type batteries. As you can see, the symbol gives a good representation of batteries.

(2) The light switch is a multi-position switch, powered from the batteries, that controls all vehicle lighting.

(3) Wiring harnesses contain electrical wiring and connectors; they are bound and the individual circuits in the bundle are identified by metal tags. These tags are affixed to the wires near the terminal end. A particular circuit will always bear the same number, regardless of the vehicle you check. For example, the wire leading to the high beam side of the headlight is always number 17 and the wire leading to the low beam side is always numbered 18. Whether these headlights are on a 1-1/4 ton or a 5-ton truck, the wires leading to them will have the same numbers.

(4) The circuit breaker is a protective device through which all current for the lights passes and is designed to open the circuit when current is in excess of what it is intended to carry. Circuits critical to vehicle operation are not run through the circuit breakers; these include the starter and alternator.

(5) A protective control box protects the electrical system in the event battery polarity is reversed. The protective control box also locks out the starter circuit, which prevents the starter from reengaging while the engine is running.

(6) The service headlights are powered through a circuit and switch that allow for high and low beam operation. You should have no difficulty identifying the symbol for headlights.

(7) The high beam selector switch, referred to as the dimmer switch, is a two-position switch that controls either the high or low beam of the service headlights when service drive lights are on.

(8) Each front composite lamp assembly consists of a single, standard military light assembly that houses the parking lights, flasher, turn signals, and blackout markers. As you can see, the symbol gives a good representation of the front composite lamp.

(9) The hazard/turn signal flasher directs power to the composite lamps to indicate the direction of a turn or operate the hazard warning lights.

(10) The rear composite lamp assemblies house the rear service drive lights, turn signals, flashers, brake lights, blackout drive, and blackout drive brake lights. The symbol for

the rear composite lamp is similar to the symbol for the front composite lamp.

(11) Side marker light assemblies are mounted on the sides of the vehicle at all four corners. Power is supplied from the light switch. The symbol for the side marker light assembly shows one lamp and ground.

(12) The turn signal switch is located on the steering column. The emergency flasher light control is located on the turn signal control. A light mounted on the turn signal control body indicates turn signal or flasher operation.

(13) Power is supplied to the brake light switch from the light switch and is activated by the brake pedal.

(14) A trailer electrical receptacle is supplied power from the light switch to operate the trailer lights. The symbol includes the pin letters in the socket lettered from A to N for proper connection.

(15) As you have seen, the shape of the symbol generally gives a good clue as to what is being symbolized.

b. Wiring Diagrams

(1) An automotive electrical wiring diagram provides the mechanic a map of the vehicle electrical wiring system, using symbols and numbers to indicate the routing of the current carrying and ground wires in a particular circuit. The wiring diagram does not identify the location of the electrical component relative to the vehicle, but does show how the components are connected.

(a) Some motor transport technical manuals have wiring diagrams of electrical components and a wiring diagram foldout of the entire vehicle electrical system. Other manuals provide only wiring diagrams for electrical components. Since

the wiring diagrams exist for some vehicles, it is important that you be able to use them to your advantage.

(b) All current automotive organizational maintenance manuals have an electrical troubleshooting section that lists malfunctions and corrective actions that are taken to correct the electrical malfunction. However, to determine the cause of an electrical component or system malfunction, the troubleshooting section of the manual may inform you to conduct a check or test on a specific wiring harness, circuit, or pin of a multiposition electrical switch. When this occurs, you need to know how to use the wiring diagrams as a tool to diagnose the cause of an electrical malfunction. That is why we are providing you this training.

(2) Obviously, the intent of this lesson is to teach you how to trace electrical circuits. To facilitate that training we will use a representative wiring and lighting system malfunction and address the procedures we would use when trying to locate a real problem. Hopefully, that will show you how the ability to trace a circuit will help you perform your duty as an automotive mechanic. Now, let's get into our malfunction and find out what tracing circuits is all about.

(3) For the sake of simplicity, let's say the malfunction is the headlamps do not light. We know the batteries are in good condition and both headlamps are okay. The problem is somewhere between the two. This is the type of problem wherein you must use the wiring diagram.

(a) Notice on the wiring diagram that wire 17F and wire 18D of the right front headlamp are connected to wire 17E and 18C of the left front headlamp.

(b) Tracing either of those wires will lead into the hood wiring harness connector.

(c) Let's trace wire 18C to the hood harness connector. Notice wire 18C has changed to 18B and is connected to pin B of the harness. Wire 18B now changes to 18A.

(d) If we have voltage at wire 18A, but not 18B, what's wrong? Is the connector loose or is it faulty? Regardless, we would tighten, repair or replace the hood wiring harness connector.

(e) Place the light switch to the service drive position and check wire 18C at the left headlight connector for voltage. If battery voltage is present, the problem is solved. If voltage is not present at wire 18C we would continue tracing and testing the circuit.

(f) Return to wire 18A of the hood harness connector and trace it to the low connector of the dimmer switch. Place the light switch to the service drive position and place the dimmer switch to low beam. Check the low beam connector for battery voltage. If battery voltage is not present, the dimmer switch is faulty and would be replaced. If voltage is present at the low beam connector we would continue with our tracing and testing.

(g) Voltage is supplied to the dimmer switch through wire 16A. Trace wire 16A to terminal M of the light switch. Disconnect wire 16A and place the light switch to the service drive position. Test terminal M of the light switch for voltage. If battery voltage is not present, replace the light switch.

(4) At this point of our training we know that automotive wiring is connected to a using component, some type of switch, or connector. Now let's set the stage for a complaint you may encounter in the fleet. The ERO states the backup lamps will not light. Using your wiring diagram, trace with a pencil, the backup lamp circuit to the backup lamp switch.

(a) As mechanics, it goes without saying, you would check the bulb for serviceability and determine if voltage is available at wire No. 467E.

(b) Trace wire No. 467D to the backup lamp switch.

(c) Test for voltage at wire No. 467C, of the backup lamp switch. If voltage is available at wire No. 467C, replace the backup lamp switch.

REFERENCE:

Student Handout - "Automotive Electrical System Wiring Diagrams"